BULLETIN 203

THE GRS WAY TO ELECTRONIC RAILROADING

GENERAL RAILWAY SIGNAL COMPANY
A UNIT OF GENERAL SIGNAL CORPORATION

Page

MOTIVE POWER CONTROL

Locomotive-To-Wayside

GRS General Reporting System 3
Radio Remote Control of Switches 5

Wayside-To-Locomotive

Radio Remote Control of Locomotives 7
High-Frequency Track Circuits 9
Mark II Train Control 10
Continuous Electronic Speed Control 11
GRS Message Coils 12

COUPLER ACTUATED POWER APPLICATION..... 13

THE AUTOMATIC RAILWAY..... 15

TRAFFIC CONTROL AND SIGNALING

Solid State cTc System 17
Zone Control 18
Jointless Electronic Track Circuits 19

ELECTRONIC HIGHWAY CROSSING PROTECTION..... 21

AUTOMATIC CAR CLASSIFICATION

Solid State Automatic Switching 23
Ultrasonic Car Presence Detector 24
Electronic Switch List Storage 25
Weight-Responsive Retarder 26

AND MORE

Compact Switch Machine 27
Electronic Signal Flasher Unit 27
Miniaturized Control Panel 28
Photo-Lamp Control and Storage Unit 28

A 2163 10-63 COPYRIGHT GENERAL SIGNAL CORPORATION 1963 © PRINTED IN U.S.A.

The era of electronic railroading, and automation, is here! On the following pages you'll see some of the GRS systems and components that help make it possible. You'll see, in many instances, where even button pushing functions have been taken over by fully integrated solid state computer systems.

You'll also see many automated railway control and signaling systems that, while not new in principle, have been vastly improved in efficiency, through miniaturization and use of solid-state components—in particular, multi-aperture magnetic cores.

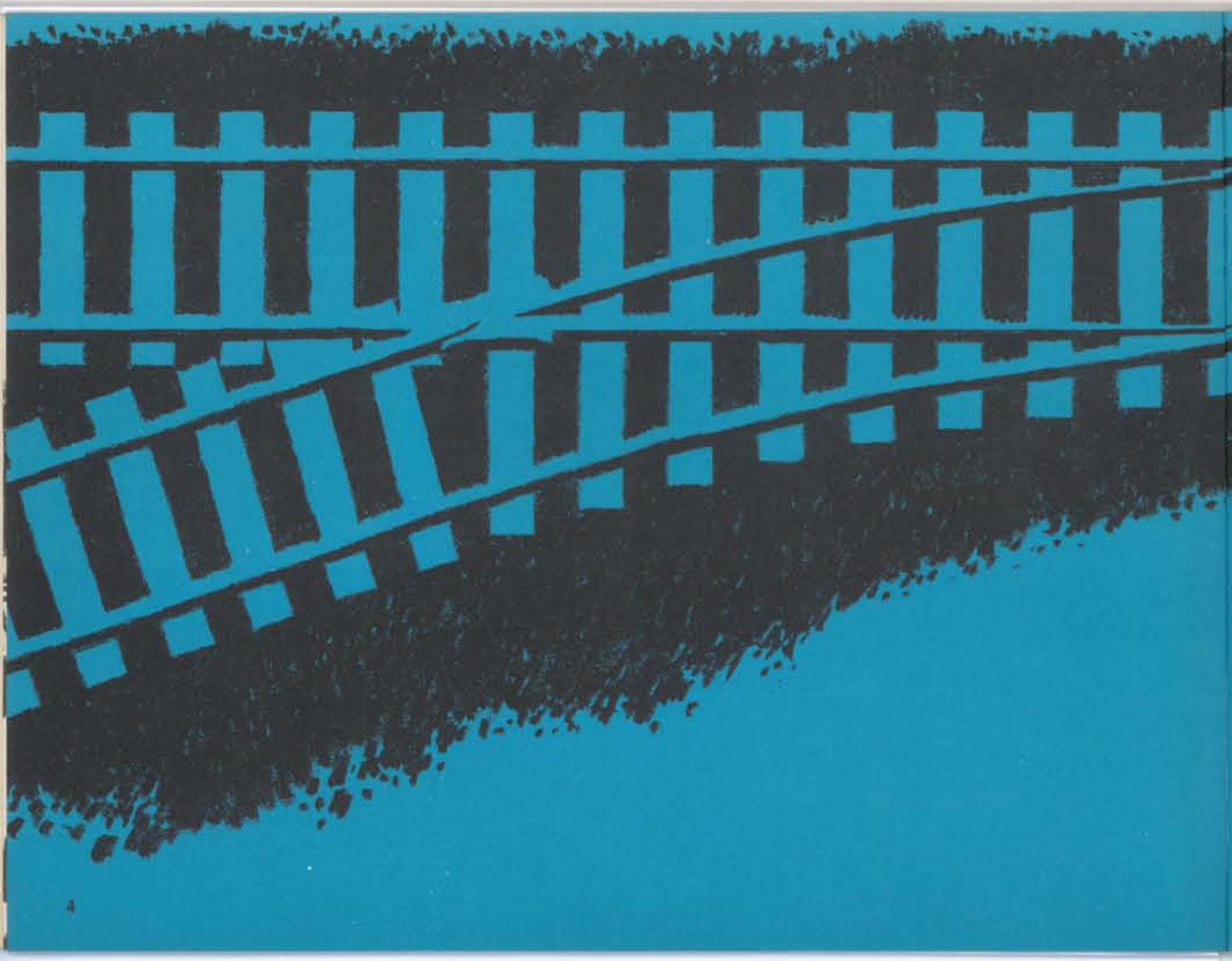
Some of these GRS systems you may already know about. Others are brand new. So new, in fact, they barely made the printing deadline for this publication. The pace of technological change in modern railroading is quickening—changing from day to day, week to week. To help you keep in step, we offer this bulletin as a ready reference to what's new *today* in electronic railroading.

Besides the sheer fascination of reading about these new electronic marvels, there's a very compelling reason why you should give each and every one of them a careful look: the concepts and designs have but one goal in mind—to provide you with a faster, better, less expensive way to run a railroad.

FOR INSTANCE YOU CAN.....

KEEP CONSTANT TAB ON TRAIN CONDITIONS

Know your motive power distribution and the condition of your manned or unmanned trains at all times. A GRS General Reporting System aboard your locomotive can transmit train number, speed, engine temperature, fuel supply, braking, speed, power application, brake applications, and other data to wayside equipment, without contact. It can do all this in 0.01 second travelling at 90 mph. After checking, storing, and transmitting the information for use at control headquarters, the wayside receiver automatically resets itself to accept information from the next train.



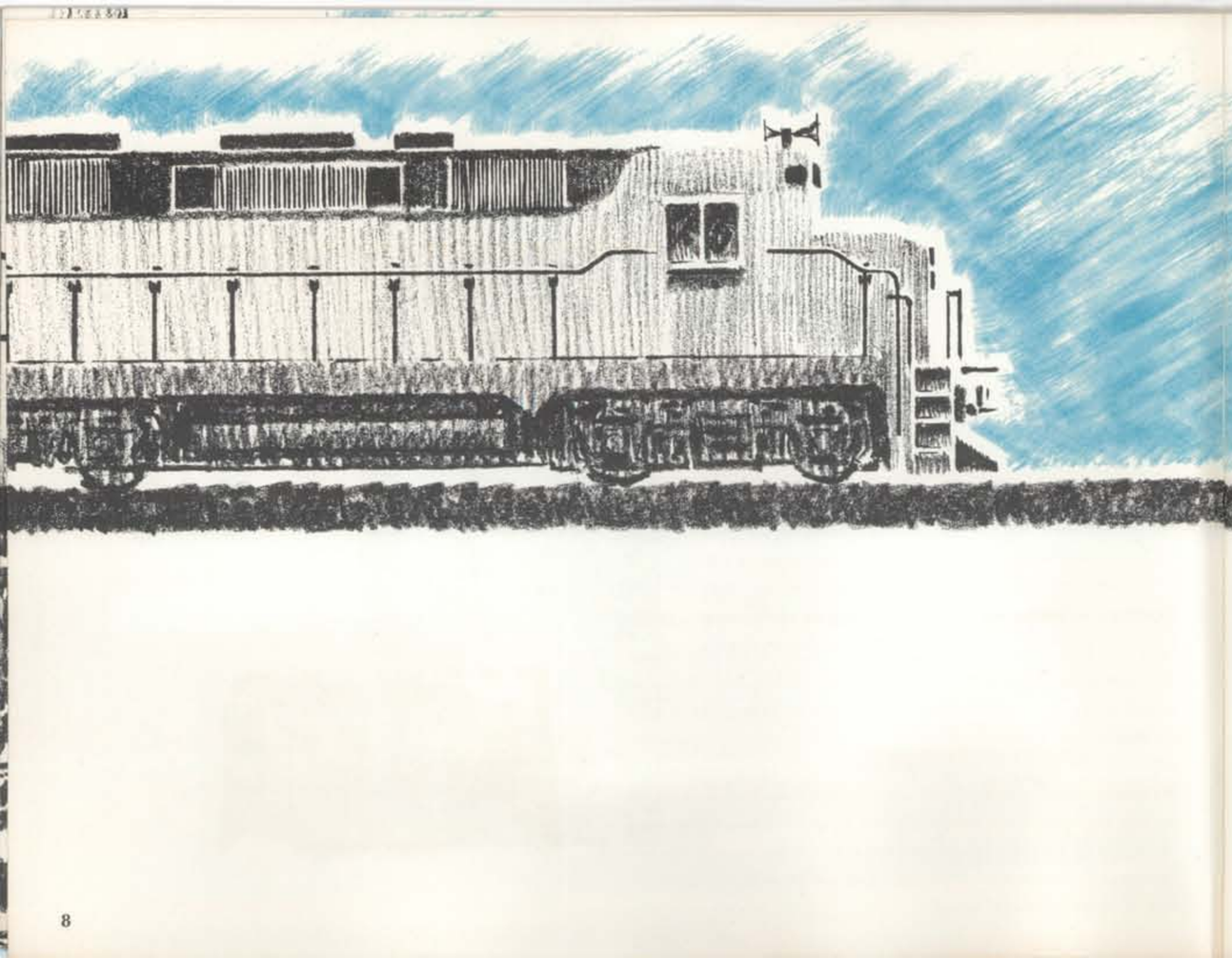
THROW SWITCHES BY RADIO FROM THE CAB

Your train approaches a switch. The engineman pushes a button in the cab. A radio tone is transmitted to a wayside receiver. The switch operates and indicates its position by a dwarf signal. That's how simple it is with GRS radio-controlled switching. Up to 100 switches can be operated by the single transmitter with no danger of signal confusion. You can even talk on the same radio channel, when control tones are not being sent, without causing unintended operation of a switch. The equipment is rugged and compact . . . extra heavy duty, portable wayside units are available to take hazards of blasting and rock fall in mine railroad operations.

CONTROL LOCOMOTIVES BY RADIO USING ONLY ONE FREQUENCY

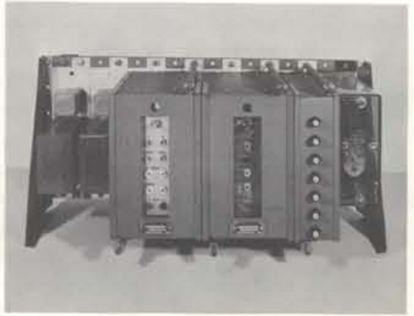
Now you can control not one, but a whole operating pattern of many locomotives, all in the same area, *on a single radio frequency*—each without interference.

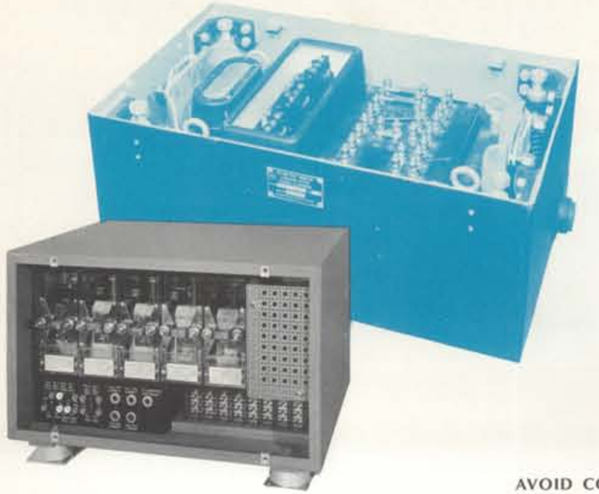
Each man has complete and accurate control of his assigned locomotive, either from a fixed station or with this compact, lightweight portable unit. He simply pushes buttons and toggle switches on his hand-held controller to release the brakes, start the locomotive and control its speed, put on the brakes, reverse direction, apply sand, signal with bell or horn, etc. He can either ride the locomotive, or dismount to work along the train. Pulse coding lets a number of locomotives work in the same area without overlapping commands. "Dead man" controls and other fail-safe features are built-in for complete reliability.



CONTROL MANNED OR UNMANNED TRAINS FROM THE WAYSIDE

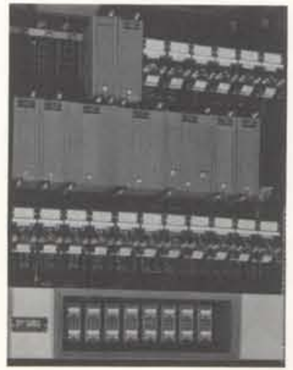
Send up to 15 messages at once, to tell your train what to do and when to do it. This GRS high frequency track circuit is a fail-safe communications link—digital or analog—between wayside and train, as well as a track occupancy detector. It's used for multiaspect cab and wayside signals, train control, or completely automatic train operation. For instance, a code is selected at the wayside to tell the train to proceed at a given speed. The message is transmitted along the rails via high frequency carrier waves modulated by up to 15 tone combinations. Equipment on the locomotive checks that *both* rails are carrying the same message, decodes the information and carries out the order, with automatic control of overspeed and braking.





AVOID COSTLY DOWN-TIME OF YOUR MOTIVE POWER

It's no longer necessary to take your locomotives temporarily out of service for required periodic checks of the inductive train control system. The new improved GRS Mark II System has plug-in modules for instant change-out on an individual basis. Your motive power stays on the job, using spare modules, while equipment undergoes periodic inspection in the shop. Other improvements in the Mark II System include: a smaller, lighter, more compact mechanism case containing components previously housed separately; epoxy resin encapsulated coils that defy vibration damage; stronger, easier-to-install receiver housing; a single-stroke bell replacing the whistle valve and eliminating pipe connections to the air system.

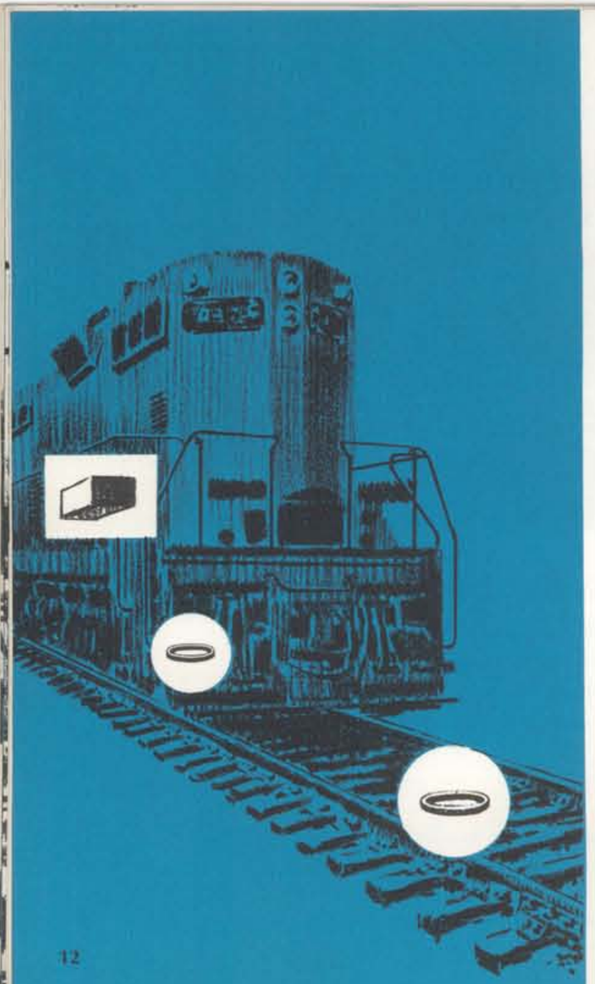


INCREASE SAFETY AND EFFICIENCY ON YOUR RAILROAD

Visibility zero, your trains still run on time with GRS Continuous Electronic Speed Control. This system gives your engineman positive information on track and block conditions ahead through both visible and audible indications in the cab, *independent of wayside signals*. Safety functions take over automatically by enforcing speed reduction and overspeed penalties if cab signals are not followed by correct human response. Even in clear weather, the system keeps trains on better schedules by eliminating time lag in wayside block signals.

Completely redesigned and repackaged, the new GRS equipment is lighter, more compact, easier to install on the locomotive. All units—relay and electronic—are plug-in type.

Case shown has full equipment for all optional features: five indications, two-rate braking, dual freight-passenger use, etc. Simpler, basic systems are also offered.

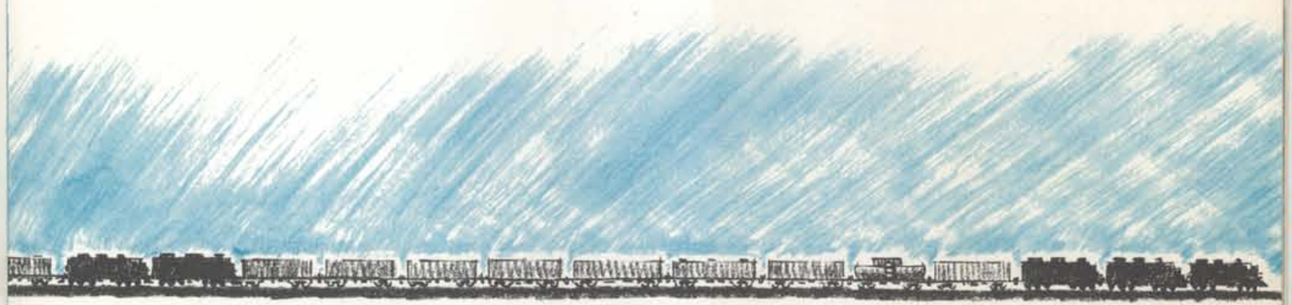


WARN TRAINS OF DANGER AHEAD

Just lay a GRS Message Coil on the ties between the tracks. When the train comes along, a similarly tuned coil on the locomotive signals the engineman—or automatic train control equipment—to slow down for danger on the tracks ahead. A service proved, convenient way to protect work gangs, or warn trains of sharp grades or curves. Wayside coils are self contained, need no external source of power. The inert tuned wayside coil, activated by the tuned locomotive coil passing over it, does the whole job. For fixed warnings, bolt-down models are available.

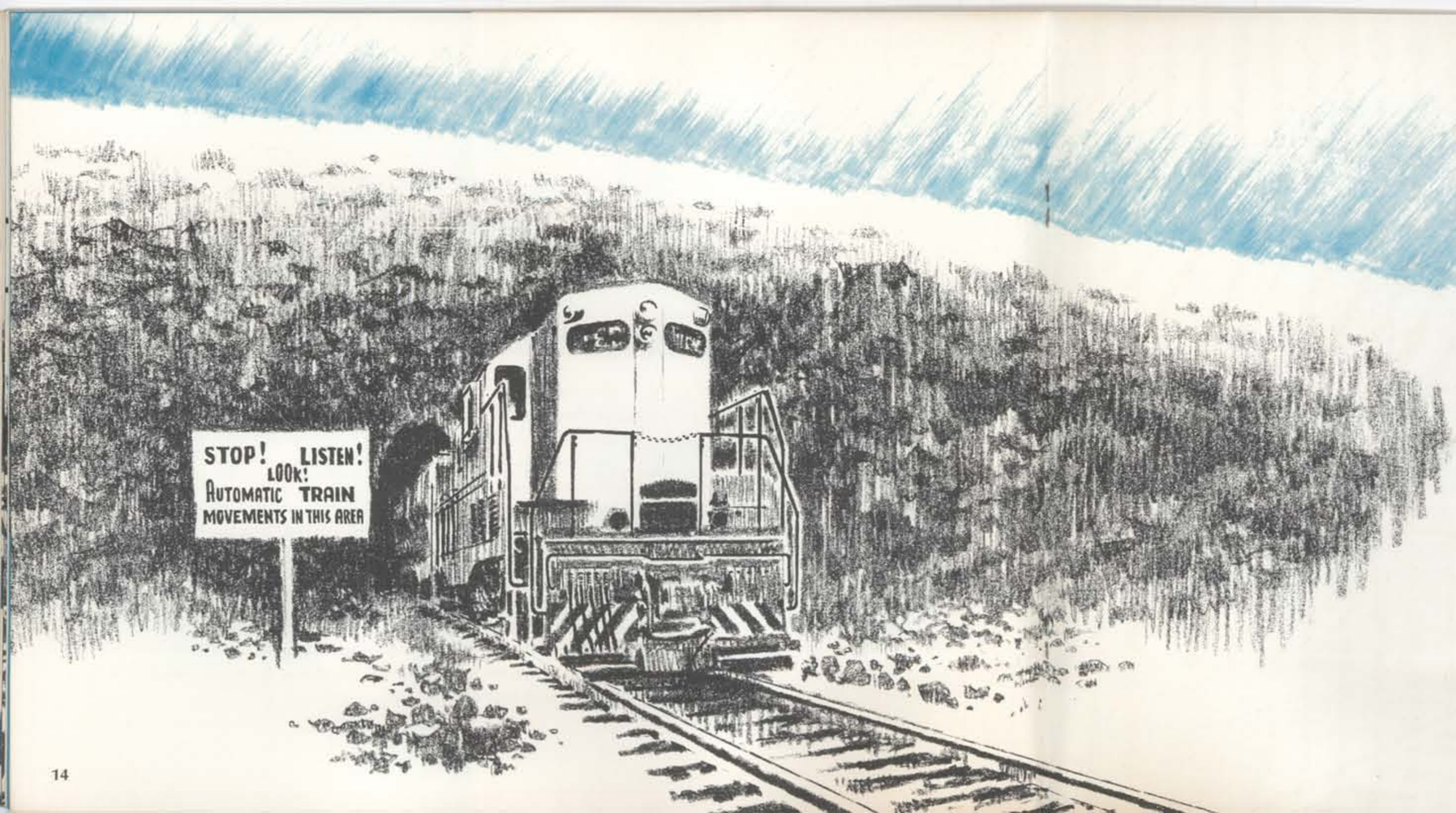
By using a "cancel" coil adjacent to the message coil, the message can be cancelled when the locomotive passes over the coils in one direction.

Message coils can also be used to identify trains, by putting the inert coil on the train and the "receiving" coil on the wayside.



PUT YOUR HELPER LOCOMOTIVES "ON THEIR OWN"

The advantages of interspersed helper engines in long trains are many: ability to block cars into separate trains, each with its motive power already in place; better control of train in undulating terrain; less lading damage due to smoother handling. Now the GRS automatic helper locomotive control system gives you completely self-contained, automatic operation of each helper unit, without any communication link with the lead locomotive. A load demand sensor on the rear coupler tells each helper when to pull and when to push over hill and dale, automatically applying power or braking as required.



RUN A COMPLETELY AUTOMATIC RAILWAY

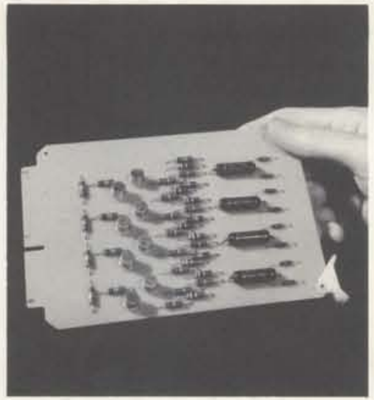
The completely automatic railway is here—not on the drawing boards, but in everyday, revenue producing operation. An outstanding example is the automatic railway in service near Labrador City since June 1962. Operating four trains simultaneously on single track, this railway is completely automated, meeting, passing, stopping, reversing, starting, and operating as required by grades, curves, and loadings. Complex maneuvers, made more smoothly than possible with manual control, include precisely maintained speeds, from 1/8 to 3/8 mph, for chute loading. Stops, for automatic car unloading, are made within a tolerance of ± 7.5 inches.

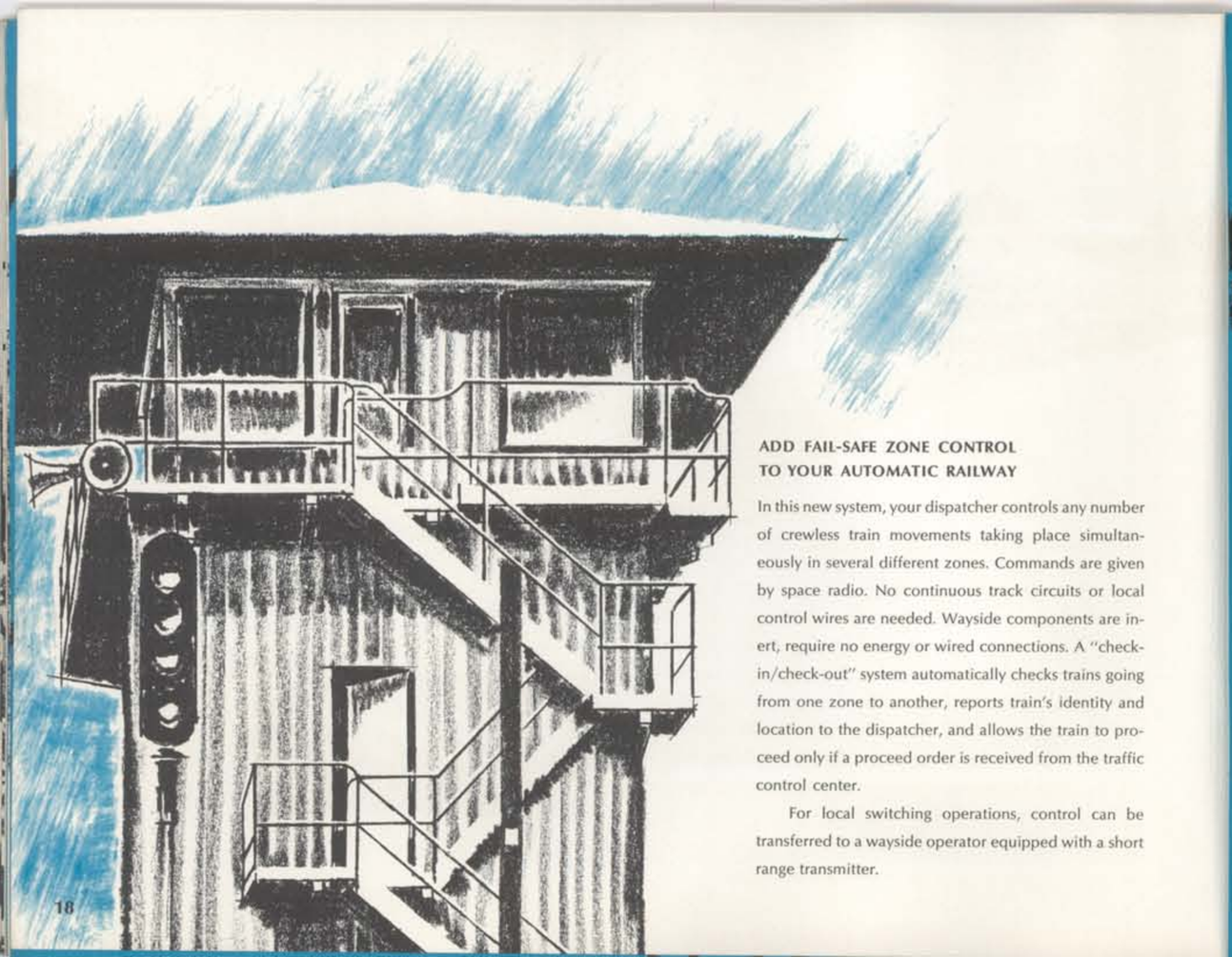
To date this railway, including all its complementary equipment, has an availability record of 96%.

GRS ATO equipment was also used to automate the New York City Transit Authority's Times Square-Grand Central shuttle train operation, placed in revenue service in January 1962.

STEP UP EFFICIENCY AND RELIABILITY IN YOUR cTc SYSTEM

You get huge traffic handling capacity, split-second speed, in the new GRS Solid State cTc system. Solid state devices, used for both coding and logic functions, are capable of switching at rates of many thousands of times per second—much faster indeed than any conceivable requirement. Thus, with GRS solid state terminal equipment, the speed of the system is determined by the speed of the available communications channel. Other advantages are: versatile plug-in modules for easy inspection changeout or to permit future expansion of system; maintenance-free features of solid-state equipment; low power consumption reduces battery requirements; power failure does not affect the magnetic memories.





ADD FAIL-SAFE ZONE CONTROL TO YOUR AUTOMATIC RAILWAY

In this new system, your dispatcher controls any number of crewless train movements taking place simultaneously in several different zones. Commands are given by space radio. No continuous track circuits or local control wires are needed. Wayside components are inert, require no energy or wired connections. A "check-in/check-out" system automatically checks trains going from one zone to another, reports train's identity and location to the dispatcher, and allows the train to proceed only if a proceed order is received from the traffic control center.

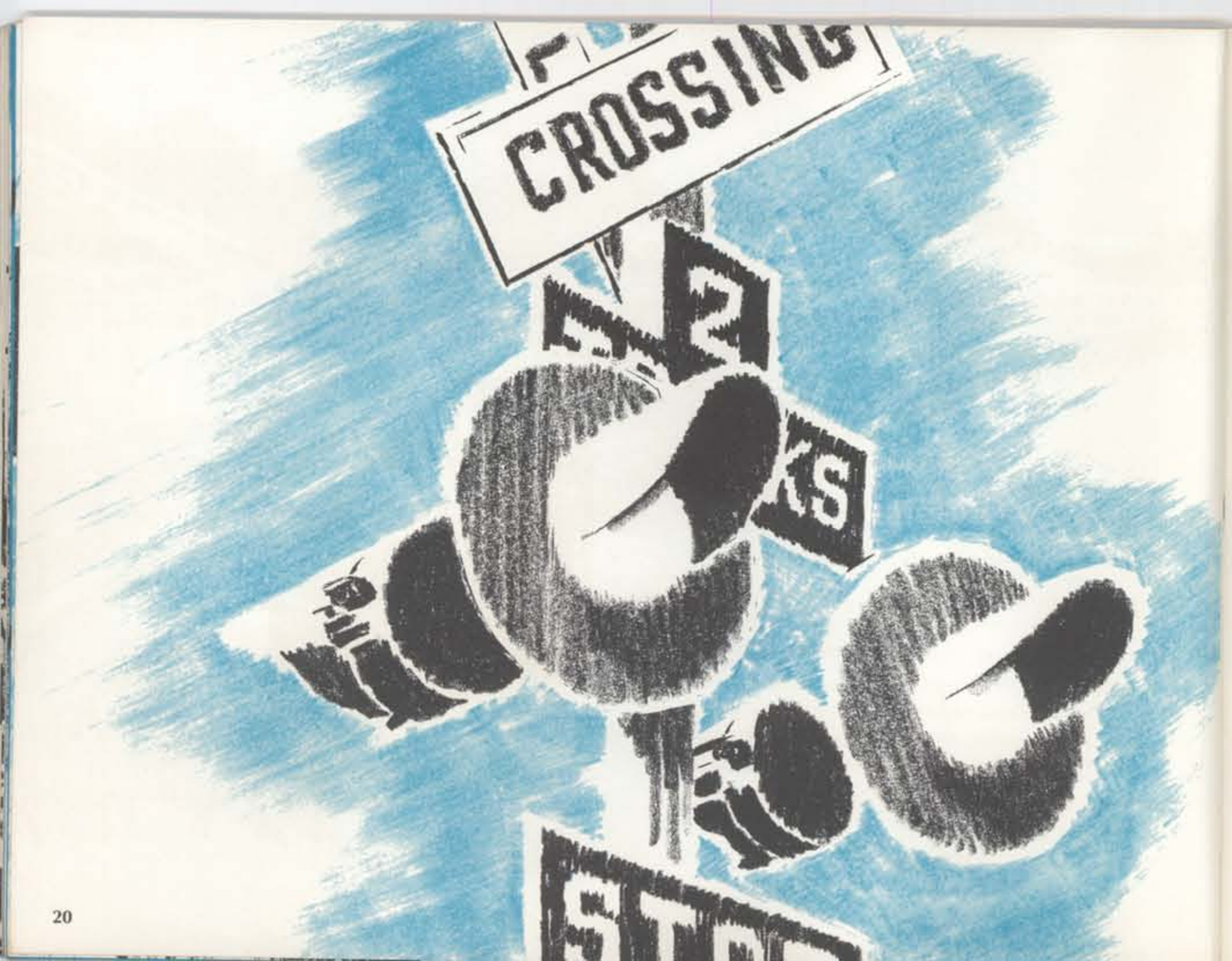
For local switching operations, control can be transferred to a wayside operator equipped with a short range transmitter.

ELIMINATE INSULATED JOINTS FOR TRACK CIRCUITS

Since their invention in 1872, closed circuit, fail-safe track circuits have been vastly improved, but they have always required insulated rail* joints, costly to install and maintain, and a particular disadvantage to rail-return electric traction lines.

Now GRS is engineering a true, jointless track circuit. It not only provides highly sensitive track occupancy detection, but can also be used to transmit controls to the train. Excellent with continuous welded rail, this new circuit also provides two-rail power return for electric traction—eliminating impedance bonds.

*While it is true that GRS electronic overlay track circuits need no insulated joints, they are used as overlays on joint-insulated circuits.

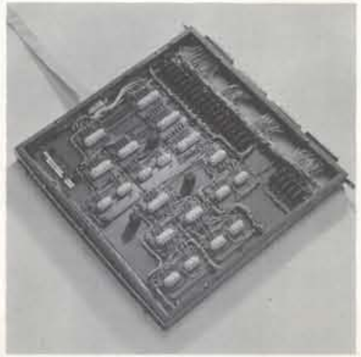


SIMPLIFY CROSSING PROTECTION

Magnetic cores and solid-state logic circuits replace relay circuitry in this GRS Electronic Highway Crossing system. Result: simpler, more reliable operations and a big saving in space and maintenance costs. Fail-safe operation is achieved by the use of multiaperture ferrite memory cores. The electronic circuits are in continuous operation, checking their ability to operate, even when no train is present.

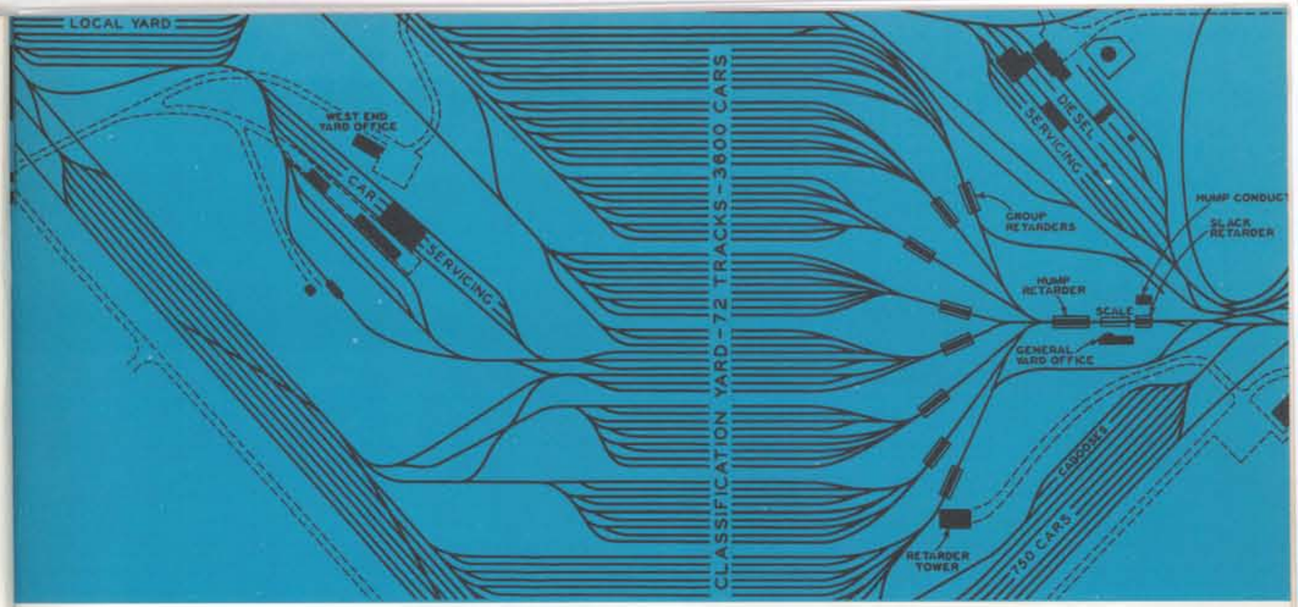
USE LESS SPACE, IN YARD TOWERS

Using multiaperture magnetic cores, this solid-state 19-inch module does the work of former equipment many times its size. The entire automatic switching system for an average car classification yard—minus the actual switch machine control relays—fits in a single 19-inch cabinet. The characteristics of this new system also permit reduction in the number of underground cables needed in the yard. Built-in indicators show operation of each module.



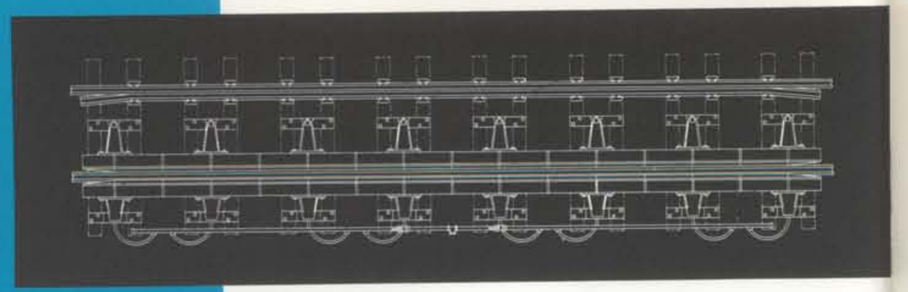
INCREASE MAXIMUM HUMPING RATE

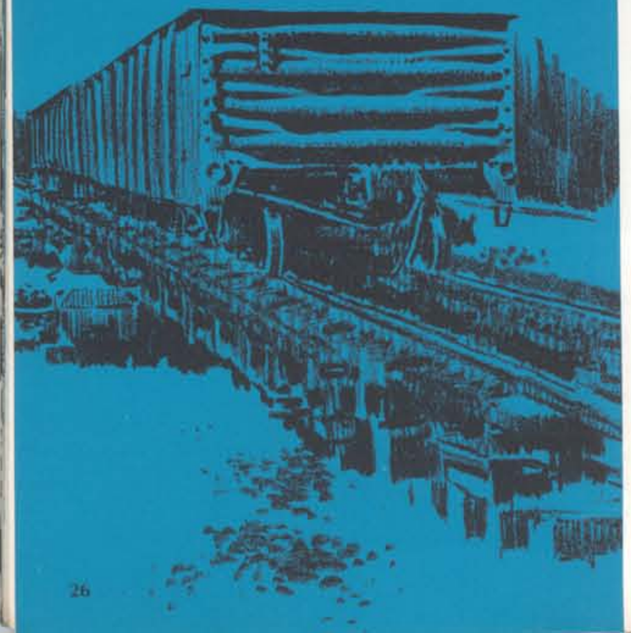
Extra long cars slow automatic yard operation because they span ordinary detector circuits, demand special handling. Extending ordinary circuits can decrease maximum humping speed as much as 17%. The GRS Ultrasonic Car Presence Detector retains the advantage of the short detector circuit for ordinary cars yet automatically detects—and "stretches" the circuit—for long cars. An ultrasonic beam does the work, independent of track circuit shunting or any actual contact with cars. Operation is fail safe, of course.



PROGRAM THE SWITCHING OF A WHOLE TRAIN—IN ADVANCE!

You can program the switching of an entire train, with as many as 150 track destinations, in advance using the GRS Electronic Switch List Storage System. An electronic, magnetic core, memory instantly records the information from the switch list as it is being teletyped. When the train is ready to be classified, you put the memory unit into the system, and all cars are routed to assigned tracks automatically. Program changes can be made manually, before the train is humped, without affecting other stored information.



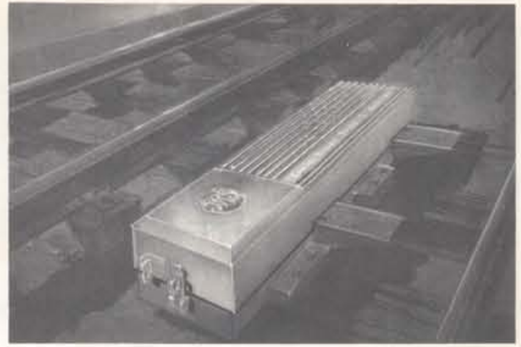


SPEED CAR HANDLING

Ideal when same velocity head must be removed from all cars—empty to 150 tons. An ingenious, extremely rugged, lever action applies braking force to car wheels in direct proportion to the weight of the car. This new single-rail retarder can be released by remote control. Designed particularly for use where car weights vary widely. Affords better control of the new heavyweight cars, too.

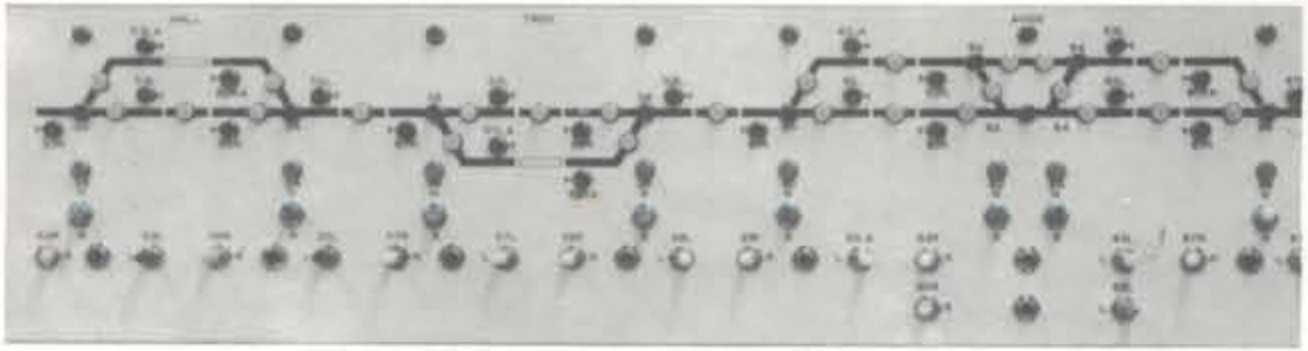
CUT SWITCH MACHINE MAINTENANCE COSTS

This new, compact, all-electric switch machine saves you operating and maintenance expense on both subway or main line freight and passenger service. It's smaller, lighter, has fewer moving parts to maintain, meets AAR load curve and thrust specifications. The permanent magnet motor with encapsulated armature is trouble-free and reliable. Practically all internal parts are exposed for easy maintenance when you take off the deep-sided cover. Sealed bearings reduce the number of lubrication points. Frost trouble is virtually eliminated.



ADD A SIGNAL ASPECT—ELECTRONICALLY

This electronic unit is a simple means of adding a flashing aspect to a block or an interlocking signal or to flash indicating lamps on a control panel. Combining a neutral relay and a solid-state coder in a single, compact unit, it is designed for well over 8000 hours of 60 flashes per minute operation with an 18-watt lamp load. Operates from battery or rectified AC. An externally mounted equalizer across the energy wires provides surge protection. The flasher holds a practically constant ratio of "On-off" time through a temperature range of −40°F to +160°F. Has quick-release wall mounting bracket and includes plug-in connectors.



PUT FOUR SIDINGS ON A 5" X 20½" PANEL

Miniaturized components and careful redesign shrinks control consoles down to where one operator can keep more than three times as much territory within his reach. The typical panel shown has complete controls and indications for four sidings. It occupies less than a third the space needed for similar facilities on older style panels.

Made of tough, easy to clean, glare-resistant vinyl, panels are available in a variety of colors. Panel material is self-extinguishing. Long life, low heat indication lamps are replaceable from front of panel. All switches and push buttons are quickly replaceable, with individual cables, push connected.

FIT A "RELAY" IN A LAMP SOCKET

Each indicating lamp on a cTc control panel usually has a relay to turn it on or off. Even the compact new Type J relay occupies 19 cubic inches of space. This unit, principally a cadmium sulfide photo resistor, is so small it fits in the socket of the indicating lamp, thus saving 100% of the former relay space. Another configuration provides a compact decade counter unit, with direct visual as well as electrical readout.

GENERAL RAILWAY SIGNAL COMPANY

A UNIT OF GENERAL SIGNAL CORPORATION

MAIN OFFICE AND PLANT ROCHESTER NEW YORK 14602 TEL. 716 ID 6-2020 CABLE: GENRASIG
NEW YORK OFFICE 230 PARK AVENUE NEW YORK NEW YORK 10017 TEL. 212 MU 9-7533
CHICAGO OFFICE PRUDENTIAL PLAZA CHICAGO ILLINOIS 60601 TEL. 312 467-1221
MONTREAL OFFICE THE ROYAL BANK OF CANADA BUILDING PLACE VILLE MARIE MONTREAL 2 CANADA 514 UN 1-1536
ST. LOUIS OFFICE 611 OLIVE STREET ST. LOUIS MISSOURI 63101 TEL. 314 MA 1-4696

GRS SYSTEMS

RAILWAY SIGNALING AND CONTROL
AVIATION
CONTROL AND TELEMETRY
MUNICIPAL ELECTRONIC
VEHICLE TRAFFIC CONTROL

OVERSEAS SUBSIDIARIES AND AFFILIATED COMPANIES

HOLLAND ALGEMENE SEIN INDUSTRIE N.V. MARIAPLAATS 3 UTRECHT NETHERLANDS (0 30) 27 571 CABLE: GENRASIG
SPAIN G.R.S. IBERICA S.A. ELOY GONZALO 27 MADRID SPAIN 224-64-35 224-99-40 CABLE: GENRASIG
MEXICO G.R.S. DE MEXICO S.A. CALLE 30 NO. 1855-ZONA IND. GUADALAJARA JALISCO MEXICO 3-58-72
ARGENTINA GENERAL RAILWAY SIGNAL CO. DE ARGENTINA S.A. EMILIO MITRE 523/31 MARTINEZ PROV. DE BUENOS AIRES ARGENTINA 792-3561 CABLE: GENRASIG

OVERSEAS REPRESENTATIVES AND LICENSEES

AUSTRALIA BRAZIL CHILE COLOMBIA EGYPT ENGLAND GREECE ITALY MEXICO TURKEY

OTHER UNITS OF GENERAL SIGNAL CORPORATION

BUDELMAN ELECTRONICS CORPORATION 375 FAIRFIELD AVE. STAMFORD CONN. 06902 TEL. 203 FI 8-9231
CARDION ELECTRONICS INC. 65 RUSHMORE ST. WESTBURY NEW YORK 11590 TEL. 516 ED 3-7900
EDWARDS COMPANY INC. 90 CONNECTICUT AVE. NORWALK CONN. 06852 TEL. 203 TE 8-8441
ELECTRONS INC. 127 SUSSEX AVE. NEWARK NEW JERSEY 07103 TEL. 201 621-9666
THE REGINA CORPORATION RAHWAY NEW JERSEY 07065 TEL. 201 FU 8-1500

GENERAL RAILWAY SIGNAL COMPANY

A UNIT OF GENERAL SIGNAL CORPORATION